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Ambient Air Quality Survey in the South Riverdale Area May/June 1986

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1.0 Executive Summary

At the request of the Central Region, the Air Resources Branch conducted an ambient air quality survey in the South Riverdale area of Toronto between May 27 and June 25, 1986. The main objectives of this survey were to determine the general air quality in this area and if possible, identify and quantitate any malodourous compounds.

In direct response to these objectives, special emphasis was placed on the determination of air quality parameters downwind of the following companies: Lever Brothers, Rothsay Concentrates, Canadian Oil, Darling Rendering, Colgate-Palmolive, A.R. Clark and the Metro Sewage Treatment Plant.

The ambient air in the South Riverdale area was screened for 125 specific volatile organic compounds and 10 other common contaminants (mainly inorganic) by the instrumentation housed in Mobile Air Monitoring Units #1 and #2. Ministry staff perceived odours downwind of the aforementioned companies and in the general South Riverdale area. The specific identity of the compounds causing these odours could not be determined by this instrumentation since no appreciable ambient air contaminant concentrations were measured. Furthermore, none of the applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the measured contaminants.

The analysis of the ambient air by the TAGA 3000 of Mobile Air Monitoring Unit #3 indicated low concentrations for polar compounds such as amines, aldehydes, alcohols and acids. The ambient two-minute average concentrations for these compounds were estimated to be in the range of 1 to 100 ug/m^3. Odours were perceived by the staff of this monitoring unit and during one of the monitoring periods in the vicinity of A.R. Clark, estimated 2-minute average ambient air concentrations of ammonia and amines ranged up to 100 ug/m^3. Given that ammonia and amines possess extremely low odour thresholds, the measured concentrations of these compounds were at sufficient levels to account for some of these odours.

2.0 Introduction

At the request of the Central Region, the Mobile Air Monitoring Units (MAMUs) #1, #2 and #3 of the Air Resources Branch undertook an ambient air quality survey in the South Riverdale Area of Toronto during the early summer of 1986. The main objectives of this survey were to determine the general air quality parameters in this area and if possible, identify and quantitate any malodourous compounds. Because of these objectives, special emphasis was placed on monitoring the ambient air downwind of the following companies: Lever Brothers, Rothsay Concentrates, Canadian Oil, Darling Rendering, Colgate-Palmolive, A.R. Clarke and the Metro Sewage Treatment Plant (Map 1).

The survey period extended from May 27 to June 26. However due to other commitments and unfavourable meteorological conditions, the MAMUs were only able to conduct monitoring in this area during the following 13 days: May 27 and 29; June 3, 4, 10, 13, 17, 18, 19, 20, 23, 24, and 25 (Tables 1 and 6). The monitoring sites are shown on Maps 2 and 3.

The instrumentation of MAMUs #1 and #2 are listed in Table 2 and the monitoring capabilities of these units are listed in Table 3. As noted in Table 3, the gas chromatographic systems (GCs) of these two MAMUs can identify and quantitate 125 different organic contaminants that may be in the ambient air. The other instrumentation housed in these two units can continuously measure a complete set of ground-based meteorological parameters and up to 10 of the more common contaminants: namely; total reduced sulphur (TRS) compounds, carbon monoxide (CO), sulphur dioxide (SO_2), total hydrocarbons (THC), oxides of nitrogen (NO_x), ozone (O_3) and mercury (Hg).

MAMU #3 houses only one analytical instrument: the Trace Atmospheric Gas Analyzer (TAGA 3000) mass spectrometer system. With its atmospheric-pressure chemical ionization ion source and different chemical ionization agents, the TAGA 3000 mass spectrometer system can rapidly screen and 'fingerprint' the ambient air for a wide variety of volatile, polar organic and inorganic compounds: namely; alcohols, amines, aldehydes, ketones, esters, acids, phenols, sulphides, mercaptans and aromatic hydrocarbons.

3.0 Results and Discussion

Because the monitoring capabilities of MAMUs #1 and #2 are different from those of MAMU #3, the air quality results obtained by the first two units will be presented in Section 3.1 and the results by the latter unit will be presented in Section 3.2.

3.1 Air Quality Data Acquired by MAMUs #1 and #2

May 27

During the morning of May 27, all instrumentation of MAMUs #1 and #2 had been calibrated and after an assessment of the prevailing meteorological conditions, monitoring of the gaseous emissions suspected to be originating from Colgate-Palmolive Limited was deemed possible.

MAMU #1 provided upwind air quality data for Colgate-Palmolive Limited and because of the prevailing winds, was positioned near the corner of Carlaw and Queen Streets. The acquisition of data for the common contaminants commenced at 11:43 hrs and as noted in Table 1, almost 2 hours of common contaminant data were acquired (monitoring period ("P) A271). As listed in Table 4, the maximum one-hour average ground level concentration (GLC) of CO was 1.9ppm (parts per million); of TRS, 0.011ppm; of THC, 2.2ppm; of NO_x, 0.09ppm; and O_3, 0.07ppm. An odour of rotten eggs was detected by the Ministry staff while at this site (this being reflected by the somewhat elevated TRS measurements) but no distinct source(s) could be ascertained. One VOC sample was acquired at this upwind site but the analysis depicted results characteristic of vehicular emissions. Because of this fact, these results are not included or even considered in this discussion.

MAMU #2 provided concurrent downwind monitoring of this suspected source. During the late morning, a weak 'detergent' odour was detected by the Ministry staff at the corner of Logan and First Avenues. This area was northwest and directly downwind of Colgate-Palmolive Limited. MAMU #2 moved to this site and commencing at 12:30 hrs, 2.5 hours of common contaminant data were acquired (MP A272, Table 1). Similar concentrations were monitored at this downwind site as to those acquired at the upwind site (A271). For example, the maximum one-hour average GLC of CO was determined to be 1.4ppm; of TRS, 0.006ppm; of SO_2, 0.008ppm; of THC, 3.0ppm; of NO_x, 0.07ppm and of O_3, 0.05ppm (Table 4). No VOC

sampling was undertaken at this downwind site and after 15:00 hrs, both MAMUs left the South Riverdale area.

May 29

Only MAMU #2 undertook ambient air monitoring in the South Riverdale area on this date. The winds were northwest and the ambient temperature was in the mid-thirties. Again, air quality monitoring downwind of Colgate-Palmolive Limited was deemed to be the best monitoring program. During the morning, the same weak 'detergent' odour was detected at the corner of Pape and Eastern Avenues, a location directly downwind of Colgate-Palmolive Limited. MAMU #2 moved to this site and commencing at 12:06 hrs, 1.7 hours of common contaminant data were acquired (MP B291, Table 1). Because of the high ambient temperatures, the temperature inside the monitoring unit became unbearable after only one hour of monitoring. In addition, gasoline fumes and other evaporative emissions from the MAMU were contaminating the sampled air (this being reflected by the higher THC concentrations after 12:30 hrs). Because of this contamination problem, the results were elevated (the maximum one-hour average GLCs for THC and CO were 6.5 and 5.0ppm - Table 4) and no VOC sampling was undertaken.

June 3

Only MAMU #1 participated in the monitoring program for the South Riverdale area on this day. It was overcast and the winds were light and southerly. An investigation of the air quality downwind of the Metro Sewage Treatment Plant was attempted and because of the prevailing winds, MAMU #1 set up in the centre of Greenwood Park. A light odour of decomposing garbage was detected by the Ministry staff at this site and commencing at 12:11 hrs, 1.6 hours of ambient air data for the common contaminants were acquired (MP A032, Table 1). However the identity of the compounds causing this odour was not determined as no significant GLCs were measured. For example, the maximum one-minute average and maximum one-hour average GLCs of TRS were only 0.007ppm and 0.005ppm respectively and for THC, its maximum one-hour average GLC was 2.0ppm (Table 4).

At 14:00 hrs, MAMU #1 moved to Larchmount Avenue (near Eastern Avenue) and was prepared for overnight monitoring. Monitoring commenced at 14:22 hrs and almost 22 hours of common contaminant data were acquired (MP A033, Table 1). A weak nocturnal inversion was present during the early morning and a gradual build-up in the concentrations of the common contaminants was evident (Graph 1). As listed in Table 4, the maximum one-hour

average GLCs for CO, THC and NO_x were 2.0, 4.5 and 0.17ppm respectively. However no exceedances of any of the applicable Ministry of the Environment Air Quality Criteria, Guidelines or Provisional Guidelines were measured and this build-up was attributed to vehicular emissions and the poor atmospheric dispersion conditions.

June 4

MAMU #1 remained at the Larchmount Avenue site and a short monitoring program for the common contaminants was started at noon. As no significant GLCs were detected (Table 4), this monitoring lasted for only one hour (MP A041).

The winds were southwest at 20 to 30 km/hr. After 13:00 hrs, MAMU #1 moved northeast of Colgate-Palmolive Limited and set up at the corner of Carlaw and Dundas Streets. The same weak 'detergent' odour was detected by Ministry staff while at this site and there was also a considerable amount of vehicular traffic in the immediate area. As noted in Table 1, monitoring of the common contaminants started at 13:36 hrs and 1.6 hours of ambient air data were acquired (MP A042). Although not listed, the maximum one-minute average GLCs for CO, THC and NO_x were 12.9, 4.3 and 0.12ppm respectively and were generally indicative of vehicular emissions. However for general air quality, the maximum one-hour average GLCs for these contaminants were 2.5, 3.3 and 0.06ppm (Table 4). These results were again indicative of an urban environment and none of the applicable Ministry of the Environment Air Quality Criteria, Guidelines or Provisional Guidelines were exceeded.

June 10

Both MAMU #1 and MAMU #2 participated in the survey program on this date. A high pressure area southeast of Lake Ontario was influencing the weather over Toronto and the winds were generally easterly and light during the morning.

MAMU #1 moved to the south end of Cherry Street and was positioned directly downwind of Darling Rendering. There was some odour from this rendering plant but shortly after the monitoring commenced, the winds veered southerly and the odour disappeared. Monitoring for the common contaminants started at 11:21 hrs (MP A101) and 1.6 hours of data were acquired. No significant GLCs were measured (Table 4) and because of the wind shift, no VOC sampling was undertaken.

At the same time, MAMU #2 was in a large parking lot near the Greenwood Racetrack. While the common contaminant analyzers were being calibrated, one VOC sample was acquired. From the resulting GC analysis, the organic concentration was low and the 36 identified organics were mainly indicative of vehicular emissions. As noted in Table 5, the total organic concentration was 198 ug/m^3 with the alkane and aromatic fractions comprising 60 and 17% of the total organic concentration respectively.

With the prevailing easterly winds, MAMU #2 investigated the air quality downwind of the Metro Sewage Treatment Plant. At noon, this monitoring unit moved to the corner of Commissioners and Leslie Streets and set up adjacent to and west of this plant. Commencing at 12:40 hrs, almost two hours of common contaminant data (MP B102) and two one-half hour VOC samples were acquired. A 'sewage' odour was noted by the staff while at this site. This odour was thought to have originated from some reduced sulphur compounds, however the maximum one-minute and one-hour average GLCs of TRS were only 0.008ppm and 0.005ppm respectively (Table 4). From the two VOC samples, the total organic concentrations were also low at 201 and 96 ug/m^3 with the alkane, aromatic and chlorinated alkane fractions comprising 37, 28 and 29% of these totals respectively. An average of 36 different organics were detected and the most prominent organic was dichloromethane at concentrations of 38 and 29 ug/m^3 (Table 5). The Ministry of the Environment Air Quality Standard for dichloromethane is 10,000 ug/m^3 (Table 3).

Meanwhile another type of odour similar to that of decaying organic matter was detected at the corner of Pape and Eastern Avenues. The odour was weak and this site was downwind of A.R. Clarke Limited. MAMU #1 moved to this location and commencing at 13:33 hrs, 1.8 hours of common contaminant data and 2 VOC samples were acquired (MP A102, Tables 1,4 and 5). Once again, low concentrations for the monitored/detected contaminants were measured. For example, the maximum one-hour average GLC for CO was only 1.7ppm; for TRS, 0.007ppm (with a maximum one-minute average GLC of 0.009ppm); for NO_x, 0.06ppm; and for THC, 4.5ppm. For the VOCs, the total organic concentrations were 243 and 169 ug/m^3 with essentially equal contributions of the alkane and aromatic fractions (44 and 43% respectively). Only 45 different organics were detected in these two samples and the aromatic concentrations were slightly higher than those detected downwind of the sewage treatment plant. Similarly, the identification of the contaminant causing this second type of odour could not be ascertained since individual organic concentrations were very low (Table 5).

June 13

Under westerly winds, an investigation of the air quality downwind of Canadian Oil was undertaken.

At noon, MAMU #1 was positioned on Villiers Avenue upwind of Canadian Oil and commencing at 12:14 hrs, 0.6 hours of common contaminant data and one VOC sample were acquired (MP A132, Tables 1, 4 and 5). At this site, low concentrations and concentrations indicative of vehicular emissions were measured.

After the upwind monitoring, MAMU #1 moved to Munition Street and was positioned adjacent to and directly downwind of Canadian Oil. A weak 'petroleum' odour was detected at this site. Commencing at 13:02 hrs, 0.7 hours of common contaminant data and one VOC sample were acquired (MP A133, Table 1). As can be seen from Tables 4 and 5, slightly higher concentrations were measured as compared to the previous upwind monitoring. The maximum half-hour average GLC of CO was 2.7ppm (as compared to 0.7ppm); of TRS, 0.007ppm (not detected); of THC, 2.7ppm (2.1ppm); and of NO_x, 0.09ppm (0.07ppm). The total organic concentration was 310 ug/m^3 and the alkane and aromatic fractions comprised 52 and 26% of this total respectively. A slight increase in the aromatics was noted, however the individual organic concentrations were still low; for example, concentrations of benzene, toluene and xylenes were only 10, 21 and 17 ug/m^3.

After 13:30 hrs, the winds veered slightly and MAMU #1 moved approximately 100 metres further south on Munition Street so as to remain downwind of Canadian Oil. A second downwind survey was started (MP A134, Table 1) and as can be seen from the data (Tables 4 and 5), almost identical ambient air quality data was acquired. Monitoring commenced at 13:46 hrs and 0.8 hours of common contaminant data and one VOC sample were acquired. For the common contaminants, the respective maximum half-hour average GLCs of CO, TRS, THC and NO_x were 1.8, 0.005, 2.9 and 0.07ppm. For the VOCs, the total organic concentration was 465 ug/m^3 and the respective contributions from the alkane and aromatic fractions were 53% (248 ug/m^3) and 35% (164 ug/m^3). Sixty-five different organics were detected in this sample but the individual concentrations were less than 35 ug/m^3.

June 17

During mid-morning, the field staff was on Villiers Street, just east of Munition. This area was downwind of Rothsay Concentrates and odours were detected. MAMU#1 moved to this site

and commencing at 10:23am, one VOC sample and 0.8 hours of common contaminant data were acquired (MP A171, Table 1). The duration of this survey was short since single source monitoring could not be undertaken because this site was also downwind of the Gardiner Expressway. From the acquired common contaminant data, the maximum 30-minute average GLC of CO was 0.9ppm (its one-minute average maximum concentration was 4.1ppm); of THC, 1.7ppm (2.0ppm); and of NO_x, 0.11ppm (0.195ppm). From the VOC sample, the total organic concentration was 568 ug/m^3 with the alkane and aromatic fractions comprising 55% (313 ug/m^3) and 35% (200 ug/m^3) of this total respectively. The individual concentrations for the low-boiling alkanes ranged up to 77 ug/m^3 (butane) and the more prominent aromatics were benzene, toluene and the xylenes at concentrations of 30, 83 and 51 ug/m^3 respectively.

Since vehicular emission contamination was obvious at this first site, MAMU #1 moved further east on Villiers Street to the Knob Hill Farms parking lot. This parking lot was still downwind of the Rothsay Concentrates (in particular, the holding tanks) yet more removed from the Gardiner Expressway. Commencing at 11:33am, 1.7 hours of common contaminant data (MP A172, Table 1) and 2 VOC samples were acquired. At the time of arrival, the winds were northerly but they continued to back as the survey progressed. Low concentrations were measured for the common contaminants (Table 4). The maximum one-hour average GLCs for CO, TRS, THC and NO_x were 0.7, 0.002 (at the detection limit), 2.0 and 0.09ppm respectively. The first VOC sample was taken directly downwind of the tankfarm. The total organic concentration was determined to be 215 ug/m^3 with the alkanes and aromatics concentrations being 130 and 59 ug/m^3 respectively. Sixty-four different organics were detected in this sample but all concentrations were less than 40 ug/m^3. During the acquisition of the second VOC sample, the winds had veered slightly and the results were deemed to be indicative of upwind measurements. The total organic concentration had decreased to 125 ug/m^3 with the alkane concentration much less at 63 ug/m^3 and the aromatic concentration remaining essentially the same at 50 ug/m^3. In the second sample, only 37 different organics were detected and the individual concentrations were all less than 15 ug/m^3.

During the early afternoon, odours were detected downwind of Canadian Oil. MAMU #1 moved to Commissioners Road and set up downwind of this plant. Commencing at 13:33 hrs, 1.7 hours of common contaminant data and 2 VOC samples were acquired (MP A173). From the common contaminant data, the respective maximum one-hour average GLCs for CO, THC, TRS, NO_x and O_3 were determined to be 1.0, 2.1, 0.006 0.09 and 0.05ppm. From analysis of the 2 VOC samples, the total organic concentrations were 510 and 273 ug/m^3 with the alkane and aromatic fractions comprising 56 and 22% of these totals respectively. A relatively large number of organics were detected in these two samples (80 and 50) but the individual concentrations

were low. The most dominant organic was propane and its concentration was only 67 ug/m^3.

MAMU #1 later moved to Villiers Street, a site upwind of Canadian Oil. Commencing at 15:25 hrs, one VOC sample and a half-hour of common contaminant data were acquired (MP A174; Tables 1, 4 and 5). As noted from these data, the concentrations were lower than those measured downwind of Canadian Oil Limited. The respective maximum half-hour average GLCs for CO, THC, TRS, NO_x and O_3 were now 1.0, 1.6, nd., 0.08 and 0.04ppm. From the analysis of the VOC sample, the total organic concentration had also decreased; now it was 61 ug/m^3 and only 25 different organics were detected.

June 18

Only an overnight monitoring program was conducted on this date. MAMU #1 was set up on Howie Street and commencing at 16:43 hrs, this program was started. Only common contaminants were monitored (MP A185; Tables 1) and from the 17 hours of acquired data, none of the applicable Ministry of the Environment Air Quality Criteria or Guidelines were exceeded. During the night, the winds were calm and between 21:00 hrs and 02:00 hrs, some elevated GLCs of CO, THC and NO_x were recorded (Graph 2 and Table 4). The respective maximum one-hour average GLCs for these contaminants were 1.3, 2.9 and 0.17ppm. The major component of NO_x was NO and its maximum one-hour average GLC was 0.12ppm. These results were indicative of vehicular emissions and/or perhaps some nearby high-temperature source(s) (furnace, oven, etc.).

June 19

During the morning, odour was detected downwind of Darling Rendering. The odour was sporadic and the winds were light northwesterly. At noon, MAMU #1 moved to this area and set up on Basin Street. Ambient air monitoring commenced at 12:27 hrs but due to the light winds, only 0.4 hours of common contaminant data and one VOC sample were acquired (MP A192). As can be seen from Tables 4 and 5, no significant GLCs for the common contaminants were recorded and the organics detected in the VOC sample were mainly alkanes (306 of the total 452 ug/m^3 or 68%). Rain commenced at 1:00pm and the monitoring was halted for the day.

June 20

During the morning of June 20, some odour was detected downwind of Darling Rendering. At noon, MAMU #1 moved to Commissioners Street, an area downwind of this plant. Monitoring

for the common contaminants commenced at 12:54 hrs (MP A202) and the VOC sampling programme was placed on stand-by. As noted in Table 4, the concentrations were low for the common contaminants and as the survey evolved, no strong or steady odours were perceived by the staff. No VOC sampling was undertaken and after 14:40 hrs, monitoring was terminated.

June 25/26

During the morning of June 25, MAMU #1 was on Larchmount Street and since the winds were light and variable, only general air quality monitoring was carried out. At 10:54 hrs, monitoring of the common contaminants commenced (MP A251). Some elevated GLCs were measured overnight as the maximum one-hour average GLCs for CO, TRS, THC, NO_x and O_3 were 1.3, nd., 4.3, 0.16, and 0.07ppm respectively. These elevated concentrations were acquired during a nocturnal inversion (Concentration/time Graph 3). The winds had remained light or calm throughout the monitoring period and because of this, no VOC samples were acquired.

At 11:00 hrs on June 26, the monitoring programme in the South Riverdale area ended.

3.2 Environmental Data as Acquired by MAMU #3 (TAGA)

3.2.1 The TAGA 'Fingerprinting' Technique

The Trace Atmospheric Gas Analyzer (TAGA) model 3000 is a specialized quadrupole mass spectrometer (MS) with a unique air sampling inlet system. Ambient air is sampled directly at a high flow rate (100 l/min.) into an atmospheric-pressure chemical ionization (APCI) ion source. Contaminants are selectively ionized according to chemical classes through the use of one of four chemical ionization (CI) reagents; namely, water to highlight oxygenated organics; oxygen to highlight oxygenated and halogenated species; benzene to highlight aromatics and sulphurous species; and ammonia to highlight nitrogenous species.

The ionization process yields a mixture of pseudo-molecular ions which are immediately subjected to mass analysis up to 250 amu. Depending on the number of CI reagents employed, mass 'fingerprinting' takes up to 20 minutes to complete. The chemical or pollutant 'fingerprint' arises from the interpretation of all of the mass spectra for a given monitoring period. Since the analysis of TAGA 3000 data is based on mass spectral interpretation the resultant chemical identities are sometimes tentative.

Owing to the system's unique features of direct air sampling and APCI technology the TAGA is highly sensitive to many polar organic pollutants in the real-time. In general, the TAGA can detect volatile compounds which contain a heteroatom, such as, N, O, P, S, or halide. The real-time limits of detection for the TAGA range from 0.1 to 10 ug/m^3 depending on the type of chemical(s) and the complexity of the sample matrix.

3.2.2 Survey Strategy

The basic survey strategy of the TAGA unit was to position the TAGA downwind of the source of interest and quickly acquire mass spectra during an odour episode. Ideally odours must be present for at least 20 minutes, the time it takes to complete fingerprinting procedures. In addition to downwind (source) monitoring the fingerprint mass scans are acquired at locations upwind (backgrounds) of the source. The source data are then background corrected by simply subtracting the upwind values from the downwind values. Background monitoring is especially important in areas of

numerous potential sources (as is the case in South Riverdale).

Tracing an odourous plume to its source of origin is based on several observations:

1) wind direction/wind speed
2) plume tracking (real-time target compound measurements while mobile)
3) odour characteristic
4) type of chemicals detected (fingerprint)

All MAMUs are equipped to monitor the wind speeds and wind directions at a height of 10 metres.

3.2.3 Results (TAGA) and Discussion

In June, 1986 the mobile TAGA unit conducted a preliminary air monitoring survey in the South Riverdale area of Toronto. The survey objective was to assist the MAMUs #1 and #2 in chemically characterizing odours associated with seven companies in the area: A.R. Clark, Colgate-Palmolive, Darling Rendering, Rothsay Concentrates, Canadian Oil, Lever Brothers, and the Metro Sewage Treatment Plant.

Considering the number of companies, the close proximity of these companies to each other, and the maximum survey time available, the survey objective was to provide a qualitative 'fingerprint' of the dominant odours in the area for a given survey day. The Ministry time spent at the various sources does not reflect the relative concerns regarding these sources, but rather the daily odour strength and monitoring logistics. Attempts were made to fingerprint, on at least one occasion, each of the seven sources.

Over the 3 week survey period there were a total of 62 monitoring periods, including background data. The downwind monitoring periods and locations for the TAGA are provided in Table 6 and Map 3 in Appendix B. Our findings are summarized below according to the aforementioned sources.

A.R. Clark

The mobile TAGA unit collected several mass spectra of the air downwind of A.R. Clark on June 3 (reference file: RD03) and 18 (RD13-16) during the occurrance of fairly strong odours. For both monitoring periods, the sampling locations were on Eastern Avenue directly opposite A.R. Clark.

Interpretation of the major features of the background corrected mass spectra revealed the presence of ammonia, diethylamine, cyclohexylamine, acetone, (possibly) butyl methacrylate, and some alkyl substituted aromatic organics (see Table 7, Appendix B). The 2-minute averaged concentrations of these compounds were estimated to be in the range of 3 to 300 ug/m^3. A possible source of the C_2 alkyl benzenes (ethyl benzene and xylenes) would be local vehicular traffic.

Given that ammonia and amines possess extremely low odour threshold detection limits, the observed concentrations of these compounds (up to 100 ug/m^3) were at sufficient levels to account for some of the odours perceived during these monitoring periods - especially sample RD03.

As a footnote to Table 7 of Appendix B and as presented in subsequent tables, the two-minute averaged concentrations are estimated to within a factor of 3 (i.e. $\pm$ 3X).

Darling Rendering

The ambient air downwind of Darling Rendering was screened for polar organics using the standard TAGA fingerprinting technique on June 19 (RD19-22) and June 24 (RD47,48). At the time of air sampling, rendering type odours were quite noticeable, albeit for brief periods sporadically distributed. As shown in Table 8 of Appendix B only traces of a few polar compounds were identified: acetic acid, propanal, butanone, propyl amine, and butylamine. (Alkyl substituted benzenes were also present but the source was probably vehicle exhaust.)

The 2-minute averaged concentrations were estimated to be extremely low: up to 5 ug/m^3 for the polar compounds. Since these contaminant levels would not account for the observed odours it is suggested that other odourous compounds were present at levels that were undetectable by APCI/MS (TAGA 3000).

Canadian Oil

The TAGA unit conducted ambient air monitoring in the vicinity of Canadian Oil on June 23 (RD33,34), 24 (RD43-46), and 26 (RD54,55) (Table 9; Appendix B). During the sampling periods 'oily' odours were quite obvious at locations downwind of Canadian Oil. As indicated by the data (fingerprint), the odours were not due to the presence of volatile polar organics which the TAGA is most sensitive towards. Only traces (up to 10 ug/m^3) of 4 polar compounds were

detected: phenol, ethanol, acetone and butanone. In addition to the aforementioned compounds, low levels of alkyl substituted benzenes were identified from the mass spectra. (Alkyl substituted benzenes are ubiquitous in the Riverdale area which has a high concentration of vehicular traffic.) It would appear from these results that the TAGA is not the appropriate technique to characterize odours from Canadian Oil.

Rothsay Concentrates

Despite the perception of odours downwind of Rothsay on June 24 (RD39,40) and 25 (RD50,51), the background-corrected mass spectra generated by the mobile TAGA were very 'clean', indicating the absence of detectable levels of polar organics. Indeed only one compound was detected: butylamine. Its estimated maximum 2-minute average concentration was 2 ug/m^3 (Table 10; Appendix B).

Colgate-Palmolive

On June 18 (RD11,12), 23 (RD27,28,32), and 25 (RD56-62), faint 'soapy' odours were perceived downwind of Colgate at sites 2,7 and 14 (Map 3). The air monitoring results provided in Table 11 show that traces of some polar compounds were detected; namely, acetone, butanone, ethanol, acetic acid and cyclohexanone.

Since the ambient concentration levels of these compounds were estimated to be extremely low (1 to 10 ug/m^3), it is believed that the 'soapy' odour was not fully characterized. It would appear that either the compounds were not detectable by the TAGA and/or the concentrations of such compounds were too low for real-time detection by APCI/MS.

Lever Brothers

Attempts were made to characterize 'detergent' odours from Lever Brothers during the morning of June 24 (RD37,38). The only compound detected by the TAGA was butylamine (Table 12; Appendix B). At the time of sampling faint rendering odours were noted (in addition to 'detergent' odours). Given the presence of rendering type odours, the wind direction (Table 6) and our monitoring location (Site 9, Map 3) it is suggested that the butylamine originated from Rothsay Concentrates and not Lever Brothers.

Metro Sewage Treatment Plant

On June 20, reduced sulphur odours were detected in the Riverdale area near Site 6 (Map 3). These odours probably originated from the Metro Sewage Treatment Plant. Attempts to fingerprint (RD25,26) the odours were fruitless for the odour durations were too brief to obtain a representative air sample for mass spectral analysis.

4.0 Summary

Between May 27 and June 25, Mobile Air Monitoring Units (MAMUs) 1, 2 and 3 of the Air Resources Branch undertook an ambient air quality survey in the South Riverdale area of Toronto. As requested by the Central Region of the Ministry of the Environment, the main objectives of this survey were to establish general air quality parameters in this area and if possible, identify and quantitate any odours. As a result of this request, special emphasis was placed on the measurement of air quality parameters downwind of the following sources: Lever Brothers, Rothsay Concentrates, Darling Rendering, Colgate-Palmolive, Canadian Oil, A.R. Clarke and the Metro Sewage Treatment Plant.

MAMUs #1 and #2 were in this area on 11 different days during this period and approximately 90 hours of continuous monitored common contaminant data were acquired. In addition, the air was also screened for 125 different organics through the gas chromatographic analyses of 15 different volatile organic samples. These samples were acquired only when odours were perceived and/or when the sampling was carried out downwind of one of the sources.

For the common contaminants, the maximum one-hour average ground level concentrations were in the ranges: 0.5 to 5ppm (parts per million) for carbon monoxide; nd.(not detected) to 0.011ppm for total reduced sulphur compounds; 2 to 6.5ppm for total hydrocarbons; 0.006 to 0.008ppm for sulphur dioxide; 0.04 to 0.17ppm for oxides of nitrogen; and 0.03 to 0.09ppm for ozone. Overnight monitoring often revealed the presence of poor atmospheric dispersion conditions (nocturnal inversions) and the buildup of gaseous contaminants (mainly of vehicular origin) in this area.

From the gas chromatographic analyses, the total volatile organic concentrations were low (100 to 500 ug/m^3 (micrograms per cubic metre)) with the alkanes usually comprising two-thirds of these totals and the aromatics one-third. Of the 125 organics that could be identified and quantitated in the sampled air, an average of only 47 different organics were found. Of these, the low-boiling alkanes (propane through hexane) and the more common aromatics (benzene, toluene and xylenes) dominated with individual concentrations usually less than 50 ug/m^3.

From the air quality data acquired by MAMU #1 and #2, the specific identity of the compounds causing the odours in this area could not be determined since no appreciable concentrations of total reduced sulphur compounds or any of the 125 specific organics were measured. In addition, none of the applicable Ministry of the

Environment Air Quality Criteria or Guidelines were exceeded for any of the measured contaminants.

Analysis of the air quality data acquired by the TAGA 3000 indicated the presence of only a few polar compounds (for example: amines, alcohols, acids, etc.). The ambient 2-minute average concentrations of these compounds generally ranged from 1 to 100 ug/m^3. Odours were detected by the staff of Mobile Air Monitoring Unit #3 but monitoring during these times revealed little if any malodourous compounds. However during one monitoring period in the vicinity of A.R. Clark, estimated 2-minute average ambient air concentrations of ammonia and amines ranged up to 100 ug/m^3. Given that ammonia and amines possess extremely low odour thresholds, the measured concentrations of these compounds were at sufficient levels to account for some of these odours.

APPENDIX A

Environmental Data as Acquired By MAMU #1 and #2

Map 1

General Area Map

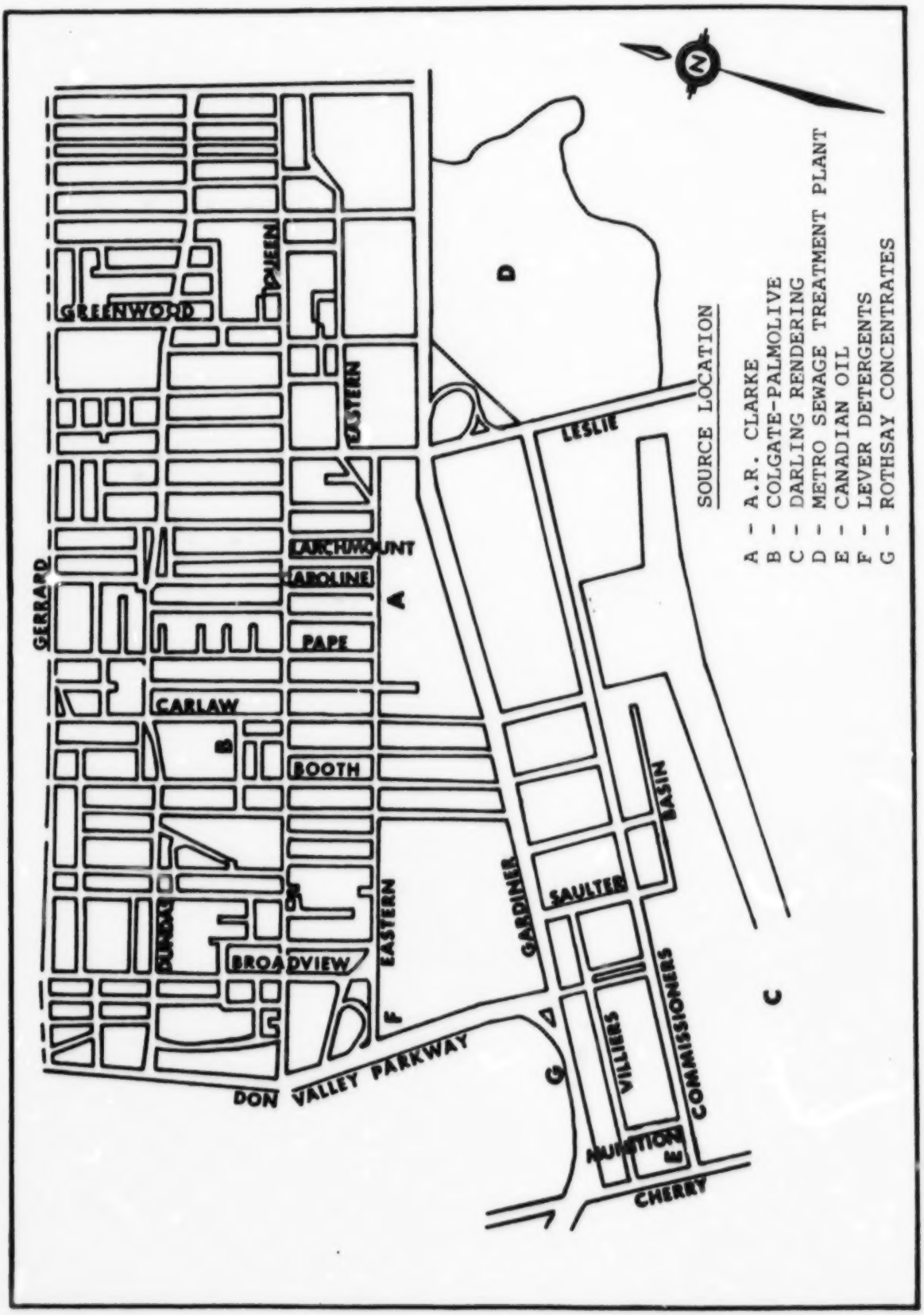

Table 1

Monitoring Sites & Durations for MAMU #1 and #2

Monitoring Period	Location	Source	Date	Start Time	Duration (#hrs)	#GC Runs
A271	Carlaw/Queen	Colgate	May 27	11:43	1.9	-
B272	Logan/First	Colgate		12:30	2.5	-
B291	Pape/Eastern	Colgate	May 29	12:06	1.7	-
A032	Greenwood Park	Sewage	June 03	12:11	1.6	-
A033	Larchmount	Overnight		14:22	21.6	-
A041	Larchmount	General	June 04	12:09	0.9	-
A042	Carlaw/Dundas	Colgate		13:36	1.6	-
A101	Cherry	Darl.Rend.	June 10	11:21	1.6	-
B102	Commissioners	Sewage		12:40	1.8	2
A102	Pape/Eastern	AR Clarke		13:33	1.8	2
A132	Villiers	Can.Oil	June 13	12:14	0.6	1
A133	Munition	Can.Oil		13:02	0.7	1
A134	Munition	Can.Oil		13:46	0.8	1
A171	Villiers/Munition	Rothsay	June 17	10:23	0.9	1
A172	Knob Hill Farms	Rothsay		11:33	1.7	2
A173	Commissioners	Can.Oil		13:32	1.7	2
A174	Villiers	Can.Oil		15:25	0.5	1
A185	Howie	Overnight	June 18	16:42	17.2	-
A192	Basin	Darl.Rend.	June 19	12:27	0.4	1
A202	Commissioners	Darl.Rend.	June 20	12:54	2.0	-
A251	Larchmount	Overnight	June 25	10:54	24.2	-

MAP 2

Monitoring Sites for MAMu#1 and #2

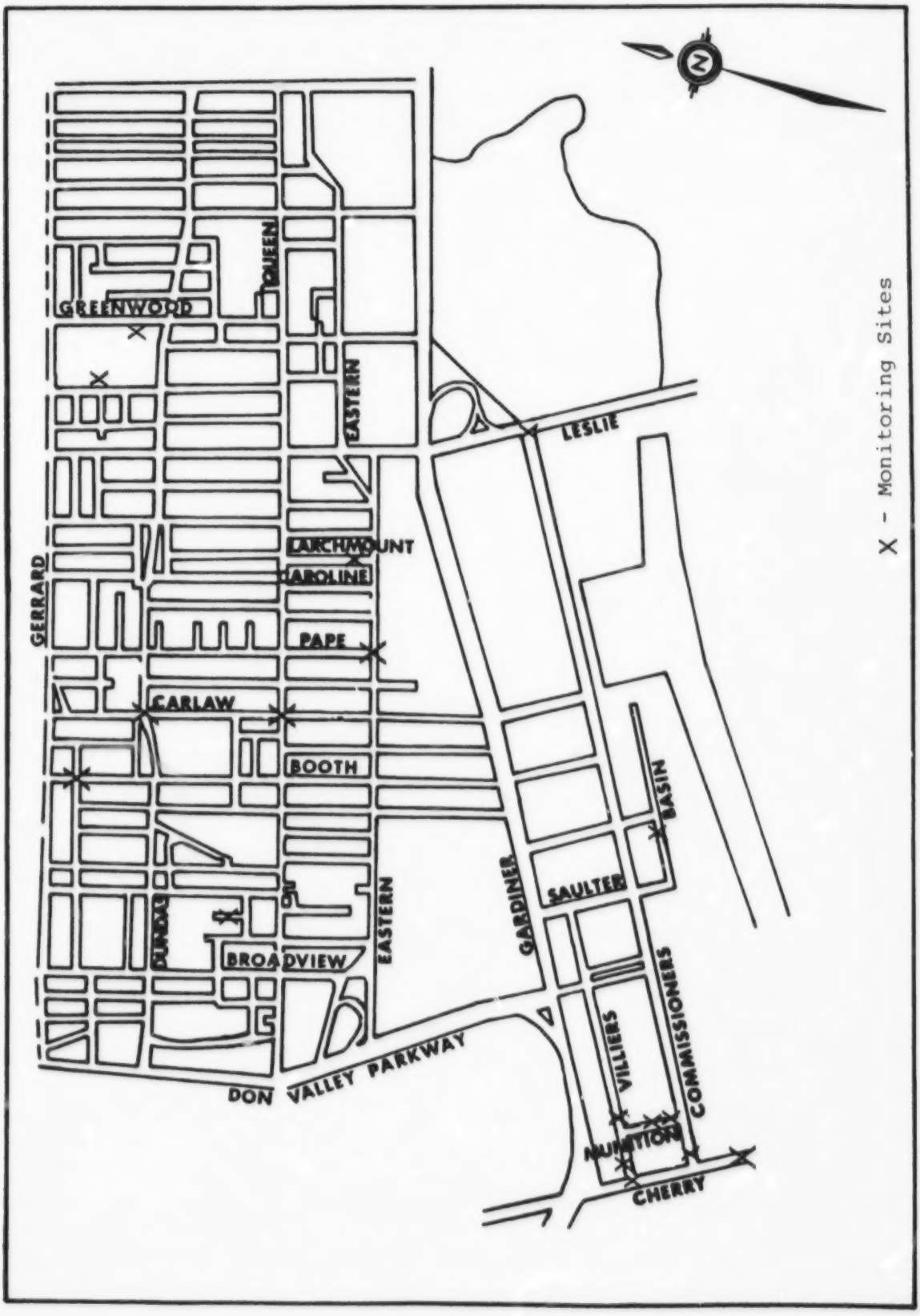

Table 2

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #1

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH4, TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH4)
H2S,SO2,NOx sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS/SO2 analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	0.5 ppm SO2 0.5 ppm TRS
NOx, NO2, NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NOx (as NO2)
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO (digital)
O3 analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O3 (digital)
Hewlett Packard Data Acquisition System - HP 85 and HP 3497A			
Gas Chromatograph	HP 5880 Dual Capillary Column c/w HP 86 Data Acquisition System	Flame Ion-ization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm2

** These instruments are located on top of a 10 metre retractable tower

Table 2 ctd.

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #2

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH4, TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH4)
H2S,SO2,NOx sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	0.5 ppm H2S
SO2 analyzer	Monitor Labs 8850	Fluorescence	0.5 ppm SO2
NOx, NO2, NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NOx (as NO2)
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO (digital)
O3 analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O3 (digital)
Hg analyzer	Scintrex HGP-2	UV Absorption	50 ug/m3

Hewlett Packard Data Acquisition System - HP 85 and HP 3497A

Gas Chromatograph	HP 5880 Dual Capillary Column c/w HP 86 Data Acquisition System	Flame Ion-ization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsi
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm

** These instruments are located on top of a 10 metre retractable tower

Table 3

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in terms of ug/m^3 (micrograms per cubic metre)

		Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
1	ETHANE	0.3					
2	PROPANE	0.2					
3	PROPADIENE	0.3					ALLENE
4	PROPYNE	0.3					METHYL ACETYLENE
5	CYCLOPROPANE	0.3					
6	CHLOROMETHANE	0.3					
7	2-METHYLPROPANE	0.3					ISOBUTANE
8	CHLOROETHENE	0.3	560 (2)	280 (A)	5000	10000	VINYL CHLORIDE; CHLOROETHYLENE
9	1-BUTENE	0.3					
10	1,3-BUTADIENE	0.3					
11	BUTANE	0.2			1900000		*n-BUTANE*
12	1-BUTYNE	0.3					ETHYLACETYLENE
13	CHLOROETHANE	0.3			2600000	3250000	ETHYL CHLORIDE
14	3-METHYL-1-BUTENE	0.3					ISOAMYLENE
15	2-METHYLBUTANE	0.3					ISOPENTANE
16	1-PENTENE	0.3					
17	PENTANE	0.2			1800000	2250000	*N-PENTANE*
18	2-METHYL-1,3-BUTADIENE	0.4					ISOPRENE
19	TRANS-2-PENTENE	0.2					
20	CIS-2-PENTENE	0.2					
21	DICHLOROMETHANE	1.5	100000 (1)	100000 (B)	350000	1740000	METHYLENE CHLORIDE

Table 3 ctd.

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in terms of ug/m^3 (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
22 2-METHYL-2-BUTENE	0.3					
23 3-CHLOROPROPENE	0.3					
24 2,2-DIMETHYLBUTANE	0.2					NEOHEXANE
25 3-METHYL-1-PENTENE	0.2					
26 4-METHYL-1-PENTENE	0.2					
27 CYCLOPENTANE	0.2					
28 2,3-DIMETHYLBUTANE	0.2					
29 2-METHYLPENTANE	0.2					
30 3-METHYLPENTANE	0.2					
31 1-HEXENE	0.3					
32 CIS-1,2-DICHLOROETHENE	0.3			790000	1900000	cis-1,2-DICHLOROETHYLENE; SYM-DICHLOROETHYLENE
33 2-CHLOROBUTANE	0.6					sec-BUTYL CHLORIDE
34 HEXANE	0.3	35000 (2)	12000 (A)	180000		*n-HEXANE*
35 TRICHLOROMETHANE	2.2	1500 (2)	500 (A)	50000	225000	CHLOROFORM
36 TRANS-3-HEXENE	0.3					
37 3-CHLORO-2-METHYLPROPENE	0.3					ISOBUTENYL CHLORIDE
38 METHYLCYCLOPENTANE	0.2					
39 1,2-DICHLOROETHANE	0.2			40000	60000	ETHYLENE CHLORIDE
40 1,1,1-TRICHLOROETHANE	1.0	350000 (1)	115000 (A)	19000000	2450000	METHYL CHLOROFORM
41 1-CHLOROBUTANE	0.4					n-BUTYL CHLORIDE
42 BENZENE	0.2	10000 (1)	3300 (A)	30000	75000	

Table 3 ctd.

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in terms of ug/m³ (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
43 TETRACHLOROMETHANE	0.9	1800 (2)	600 (A)	20000	125000	CARBON TETRACHLORIDE
44 CYCLOHEXANE	0.2	300000 (2)	100000 (A)	1050000	1300000	HEXAHYDROBENZENE
45 2,3-DIMETHYLPENTANE	0.3					
46 2-METHYLHEXANE	0.5					ISOHEPTANE
47 CYCLOHEXENE	0.3			1015000		
48 1,2-DICHLOROPROPANE	0.6					PROPYLENE CHLORIDE
49 3-METHYLHEXANE	0.5					
50 2,3-DICHLOROPROPENE	0.7			5000	50000	2,3-DICHLOROPROPYLENE
51 TRICHLOROETHENE	0.3	85000 (1)	28000 (A)	270000	1080000	TRICHLOROETHYLENE
52 2,2,4-TRIMETHYLPENTANE	0.2					ISOOCTANE
53 1-HEPTENE	0.3					
54 HEPTANE	0.2			1600000	2000000	*n-HEPTANE*
55 1-CHLORO-3-METHYLBUTANE	0.6					
56 TRANS-2-HEPTENE	0.3					
57 METHYLCYCLOHEXANE	0.2			1600000	2000000	HEXAHYDROTOLUENE
58 4-METHYLCYCLOHEXENE	0.3					
59 2,5-DIMETHYLHEXANE	0.5					
60 1-CHLOROPENTANE	0.4					n-AMYL CHLORIDE; PENTYL CHLORIDE
61 1,1,2-TRICHLOROETHANE	1.1					VINYL TRICHLORIDE
62 TOLUENE	0.2	2000 (1)	2000 (A)	375000	560000	*METHYLBENZENE*; PHENYLMETHANE
63 1,3-DICHLOROPROPANE	0.7			350000	510000	TRIMETHYLENE CHLORIDE

Table 3 ctd.

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in terms of ug/m^3 (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
64 2-METHYLHEPTANE	0.2					
65 4-METHYLHEPTANE	0.2					
66 3-METHYLHEPTANE	0.2					
67 1,2-DIBROMOETHANE	2.1					ETHYLENE DIBROMIDE; ETHYLENE BROMIDE
68 1-OCTENE	0.4	150000 (3)	50000 (A)			
69 TRANS12DIMETHYLCYCLOHEXANE	0.3					*trans-1,2-DIMETHYLCYCLOHEXANE
70 TRANS-4-OCTENE	0.3					
71 TETRACHLOROETHENE	0.9	10000 (2)	4000 (A)	335000	1340000	TETRACHLOROETHYLENE; PERCHLOROETHYLENE
72 OCTANE	0.3	45400 (3)	15300 (A)	1450000	1800000	*n-OCTANE*
73 2-METHYL-1-HEPTENE	0.3					
74 2-OCTENE	0.6					
75 CIS12DIMETHYLCYCLOHEXANE	0.2					
76 CHLOROBENZENE	0.4			350000		PHENYL CHLORIDE
77 ETHYLCYCLOHEXANE	0.1					
78 PROPYLCYCLOPENTANE	0.5					
79 1-CHLOROHEXANE	0.5					n-HEXYL CHLORIDE
80 ETHYLBENZENE	0.3	4000 (1)	4000 (B)	435000	545000	
81 M-XYLENE	0.3	2300 (4)	2300 (A)	435000	655000	*1,3-DIMETHYLBENZENE*
82 4-METHYLOCTANE	0.3					
83 2-METHYLOCTANE	0.3					
84 STYRENE	0.5	400 (1)	400 (A)	215000	425000	*ETHENYLBENZENE*; PHENYLETHYLENE; VINYLBENZENE

Table 3 ctd.

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in terms of ug/m³ (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
85 1,4-DICHLOROBUTANE	0.3					
86 O-XYLENE	0.3	2300 (4)	2300 (A)	435000	655000	*1,2-DIMETHYLBENZENE*
87 1,1,2,2-TETRACHLOROETHANE	2.6					ACETYLENE TETRACHLORIDE
88 1,2,3-TRICHLOROPROPANE	1.3			300000	450000	TRICHLOROHYDRIN
89 1-NONENE	0.7					
90 NONANE	0.3			1050000	1300000	*n-NONANE*
91 ISOPROPYLBENZENE	0.3	100 (3)	100 (B)			*(1-METHYLETHYL)BENZENE*; CUMENE
92 2-CHLOROTOLUENE	0.3					*2-CHLORO-1-METHYLBENZENE*; o-TOLYL CHLORIDE; o-CHLOROTOLUENE
93 3-CHLOROTOLUENE	0.5					*3-CHLORO-1-METHYLBENZENE*; m-TOLYL CHLORIDE; m-CHLOROTOLUENE
94 4-CHLOROTOLUENE	0.5					*4-CHLORO-1-METHYLBENZENE; p-TOLYL CHLORIDE; p-CHLOROTOLUENE
95 PROPYLBENZENE	0.4					n-PROPYLBENZENE
96 3-ETHYLTOLUENE	0.3					*1-ETHYL-3-METHYLBENZENE*; M-ETHYLTOLUENE
97 4-ETHYLTOLUENE	0.3					*1-ETHYL-4-METHYLBENZENE*; P-ETHYLTOLUENE
98 1,3,5-TRIMETHYLBENZENE	0.4			125000	170000	MESITYLENE
99 2-ETHYLTOLUENE	0.3					*1-ETHYL-2-METHYLBENZENE*; O-ETHYLTOLUENE
100 1,2,4-TRIMETHYLBENZENE	0.4	100 (2)	1000 (A)	125000	170000	PSUEDOCUMENE
101 tert-BUTYLBENZENE	0.3					*(1,1-DIMETHYLETHYL)BENZENE*
102 1,3-DICHLOROBENZENE	0.8					
103 1-DECENE	1.3	180000 (3)	60000 (A)			n-DECYLENE
104 (CHLOROMETHYL)BENZENE	4.3					alpha-CHLOROTOLUENE; BENZYL CHLORIDE
105 1,5-DICHLOROPENTANE	0.3					

Table 3 ctd.

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in terms of ug/m³ (micrograms per cubic metre)

		Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
106	DECANE	0.5					*n-DECANE*
107	SEC-BUTYLBENZENE	0.2					*(1-METHYLPROPYL)BENZENE*
108	3-(CHLOROMETHYL)HEPTANE	0.3					
109	1,2,3-TRIMETHYLBENZENE	0.4			125000	175000	HEMIMELLITENE
110	1ISOPROPYL4METHYLBENZENE	0.5					*METHYL(4-METHYLETHYL)BENZENE*; 3-ISOPROPYLTOLUENE; P-CYMENE
111	1,2-DICHLOROBENZENE	0.3					o-DICHLOROBENZENE
112	INDAN	0.5					*2,3-DIHYDRO-1H-INDENE*; 2,3-DIHYDROINDENE; HYDRINDENE
113	BUTYLCYCLOHEXANE	0.4					n-BUTYLCYCLOHEXANE; 1-CYCLOHEXYLBUTANE
114	1,3-DIETHYLBENZENE	0.4					m-DIETHYLBENZENE
115	1,4-DIETHYLBENZENE	0.5					p-DIETHYLBENZENE
116	BUTYLBENZENE	0.3					n-BUTYLBENZENE
117	1,2-DIETHYLBENZENE	0.5					o-DIETHYLBENZENE
118	T-DECALIN	0.3					trans-DECAHYDRONAPHTHALENE; BICYCLO[4,4,0]DECANE
119	C-DECALIN	0.3					cis-DECAHYDRONAPHTHALENE; BICYCLO[4,4,0]DECANE
120	UNDECANE	0.8					*n-UNDECANE*; HENDECANE
121	1235-TETRAMETHYLBENZENE	0.6					ISODURENE
122	1234-TETRAMETHYLBENZENE	0.6					PREHNITENE
123	1234TETRAHYDRONAPHTHALENE	0.6					TETRALIN
124	1,4-DIISOPROPYLBENZENE	0.8					*1,4-BIS(1-METHYLETHYL)BENZENE*; ISOPROPYLCUMENE
125	DODECANE	1.3					*n-DODECANE*

Table 3 ctd.

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMUs #1 and #2

All concentrations are in terms of ug/m^3 (micrograms per cubic metre)

Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names

NOTES:
(1) Standard
(2) Guideline
(3) Provisional Guideline
(4) Standard for the sum of o-, m-, & p- Xylenes

(A) Ambient Air Quality Criterion based on a 24-hour average concentration
(B) Ambient Air Quality Criterion based on a 1-hour average concentration
(please note; if the maximum 1-hour average concentration of a contaminant is LESS than the Criterion concentration based on a 24-hour average, then that Criterion has NOT been exceeded.)

TWA - Time Weighted Average for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed without adverse effect.

STEL - Short Term Exposure Limit - concentration to which workers can be exposed for a short period of time (15 minutes) without adverse effect.

* - Denotes name approved by the International Union of Pure and Applied Chemistry (IUPAC).

Table 3 ctd.

Characteristics of the Common Contaminants as Measured Continuously by MAMu's #1 and #2

All concentrations are in terms of ppm (parts per million)

	Detection Limits	Standards, Guidelines or Provisional Guidelines		Criterion	TWA	STEL		Alternate Names	
1 SULPHUR DIOXIDE	0.005	0.300		0.25	2	5		SO2	SULFUR DIOXIDE
2 TOTAL REDUCED SULPHUR	0.005	0.027	*	0.027	10	15	**	TRS	
3 NITROGEN OXIDES	0.01	0.25	***	N/A	-	-		NOx	OXIDES of NITROGEN
4 NITROGEN DIOXIDE	0.01	N/A		0.20	5	5		NO2	
5 NITRIC OXIDE	0.01	N/A		N/A	25	35		NO	NITROGEN MONOXIDE
6 OZONE	0.01	0.1		0.08	0.1	0.3		O3	
7 CARBON MONOXIDE	0.1	5.0		30.0	50	400		CO	

* As equivalent H2S and applicable only for Kraft Pulp Mills
TRS may contain any of the following: Hydrogen Sulphide (H2S), Methyl Mercaptan (CH3SH), Dimethyl Sulphide (C2H6S) and Dimethyl Disulphide (C2H6S2).

** The TWA and STEL for TRS is expressed solely for Hydrogen Sulphide concentrations

*** Expressed as NO2

Table 4

Riverdale 1986 Survey - Common Contaminants

Maximum One-hour and Half-hour Average Ground Level Concentrations

Monitoring Period	Duration (#hrs)	CO	TRS	THC	SO2	TH-M	NOx	O3	
A271	1.9	1.9	0.011	2.2	-	1.14	0.09	0.07	
B272	2.5	1.4	0.006	3.0	0.008	2.09	0.07	0.05	
B291	1.7	5.0	0.005	6.5	0.005	4.33	-	0.03	
A032	1.6	0.7	0.005	2.0	-	0.72	0.04	-	
A033	21.6	2.0	0.004	4.5	-	1.81	0.17	-	
		0.9	n/a	1.9	-	0.83	0.08	-	**
A041	0.9	0.8	0.007	3.2	-	1.69	0.05	-	*
A042	1.6	2.5	0.007	3.3	-	1.93	0.06	-	
A101	1.6	0.8	0.004	3.0	-	1.86	0.04	-	
B102	1.8	0.5	0.005	3.1	0.006	1.37	0.01	0.08	
A102	1.8	1.7	0.007	4.5	-	2.45	0.06	-	
A132	0.6	0.7	nd.	2.1	-	1.05	0.07	0.05	*
A133	0.7	2.7	0.007	2.7	-	1.60	0.09	0.04	*
A134	0.8	1.8	0.005	2.9	-	1.75	0.07	0.05	*
A171	0.9	0.8	nd.	1.7	-	0.71	0.11	0.04	*
A172	1.7	0.7	0.002	2.0	-	0.98	0.09	0.05	
A173	1.7	1.0	0.006	2.1	-	1.17	0.09	0.05	
A174	0.5	0.9	nd.	1.6	-	0.67	0.08	0.04	*
A185	17.2	1.3	0.003	3.0	-	1.58	0.17	0.05	
		0.8	n/a	2.3	-	1.17	0.08	0.02	**
A192	0.4	2.5	0.003	2.7	-	1.39	0.18	0.02	**
A202	2.0	0.5	0.005	2.0	-	0.86	0.06	0.09	
A251	24.2	1.3	nd.	4.3	-	3.25	0.16	0.07	
		0.7	nd.	2.3	-	1.21	0.07	0.03	**

All concentrations are in ppm - parts per million by volume

* Maximum half-hour average concentrations
** Sampling period average concentration
n/a not applicable
nd. not detected

(Please refer to Table 1 for Monitoring Times and Locations)

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Table 5
Riverdale 1986 Gas Chromatographic Data

All Units: ug/m3 (micrograms per cubic metre

	MAMU 2 N/A Upwind JUN 10 11:52	MAMU 2 B102 Sewage JUN 10 13:17	MAMU 2 B102 Trt. Plt. JUN 10 14:32	MAMU 1 A102 AR JUN 10 14:33	MAMU 1 A102 Clarke JUN 10 15:33	MAMU 1 A132 JUN 13 12:28	MAMU 1 A133 Canadian Oil JUN 13 13:41	MAMU 1 A134 JUN 13 14:42	MAMU 1 A171 Rothsay JUN 17 11:25	MAMU 1 A172 Concentrates JUN 17 12:40	MAMU 1 A172 JUN 17 13:23	MAMU 1 A173 Canadian JUN 17 14:44	MAMU 1 A173 Oil JUN 17 15:26	MAMU 1 A174 Upwind JUN 17 16:09	MAMU 1 A192 Darl. Re JUN 19 13:00
1 ETHANE															
2 PROPANE	2.3	3.2		22.9	38.2	2.0	1.9	10.4	23.2	3.1	5.6	67.0	5.2		46.2
3 PROPADIENE												0.9			2.2
4 PROPYNE															
5 CYCLOPROPANE															
6 CHLOROMETHANE	22.3	16.8		5.9		5.4	3.4				4.5				12.3
7 2-METHYLPROPANE	4.9	3.3		2.8	3.6	4.7		6.4	17.0	5.7		16.8			17.7
8 CHLOROETHENE															
9 1-BUTENE				1.6	1.8				5.0	3.3	5.4				7.3
10 1,3-BUTADIENE													2.5		
11 BUTANE	19.8	10.9	3.4	12.7	14.0	16.5	33.5	17.7	77.3	39.6	11.9	50.7		3.9	97.6
12 1-BUTYNE															
13 CHLOROETHANE															
14 3-METHYL-1-BUTENE															
15 2-METHYLBUTANE	29.4	14.6	3.0	8.2	9.5	9.1	30.8	14.3	46.6	16.3	7.3	30.5	26.5		54.2
16 1-PENTENE	1.3	0.7					5.3	3.6				7.1			
17 PENTANE	18.5	10.0	2.3	3.7	4.9	5.5	23.4	17.5	46.3	9.3	4.9	27.3	19.6	7.3	30.0
18 2-METHYL-1,3-BUTADIENE	1.3											1.3			
19 TRANS-2-PENTENE	1.8	1.1		0.3	0.5	0.5	2.7	1.4	1.7	0.9		3.8	2.4		3.2
20 CIS-2-PENTENE	1.0				0.3					0.6		2.2	1.5		

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Table 5 cont.
Riverdale 1986 Gas Chromatographic Data

All Units: ug/m3 (micrograms per cubic metre)

	MAMU 2 N/A Upwind JUN 10 11:52	MAMU 2 B102 Sewage JUN 10 13:17	MAMU 2 B102 Trt. Plt. JUN 10 14:32	MAMU 1 A102 AR JUN 10 14:33	MAMU 1 A102 Clarke JUN 10 15:33	MAMU 1 A132 JUN 13 12:28	MAMU 1 A133 Canadian Oil JUN 13 13:41	MAMU 1 A134 JUN 13 14:42	MAMU 1 A171 JUN 17 11:25	MAMU 1 B172 Rothsay Concentrates JUN 17 12:40	MAMU 1 A172 JUN 17 13:23	MAMU 1 A173 Canadian JUN 17 14:44	MAMU 1 A173 Oil JUN 17 15:26	MAMU 1 A174 Upwind JUN 17 16:09	MAMU 1 A192 Darl. Rend. JUN 19 13:00
21 DICHLOROMETHANE		37.7	29.2									8.8			
22 2-METHYL-2-BUTENE	5.1	3.3	1.4	1.2	1.1		9.0	4.8		2.3		13.7	8.7		
23 3-CHLOROPROPENE												1.0			
24 2,2-DIMETHYLBUTANE	1.1			0.3	0.4			0.7	3.7	0.7	0.8	1.4	1.8	0.5	
25 4-METHYL-1-PENTENE								2.9				5.2	3.2		
26 3-METHYL-1-PENTENE								1.7		0.3		3.1	1.9		
27 CYCLOPENTANE	2.5	1.7	0.9	0.4	0.5	1.6		0.9	2.7	0.8	0.5	2.1	1.6	0.7	
28 2,3-DIMETHYLBUTANE	3.0	2.0		0.5	0.7	2.9	2.2	3.2	3.4	1.4	0.7	2.7	2.2	0.8	
29 2-METHYLPENTANE	10.8	6.1	1.6	2.2	3.2	21.4	11.5	23.4	15.9	8.3	4.5	15.0	11.6	3.9	
30 3-METHYLPENTANE	6.8	3.8	0.9	2.0	2.7	24.7	7.2	25.7	14.2	7.5	4.6	8.6	8.4	2.8	11.1
31 1-HEXENE							2.3	1.3		0.8		2.4	1.8		0.8
32 cis-1,2-DICHLOROETHENE															2.2
33 2-CHLOROBUTANE															
34 HEXANE	10.6	6.4	2.5	1.6	4.0	45.9	11.4	49.1	13.9	11.7	6.0	15.1	11.2	2.7	14.2
35 TRICHLOROMETHANE															
36 TRANS-3-HEXENE							0.7	0.5		0.3		0.8	0.6		0.7
37 3-CHLORO-2-METHYLPROPENE										0.5		1.5	1.1		
38 METHYLCYCLOPENTANE	4.0	2.3	0.6	0.7	1.2	6.4	4.1	7.3	5.7	2.6	1.6	5.4	4.3	1.5	1.3
39 1,2-DICHLOROETHANE															
40 1,1,1-TRICHLOROETHANE			2.1	7.2	7.8	6.0	14.2	12.4	27.6	6.7		19.7	16.7	6.3	11.1
41 1-CHLOROBUTANE							0.8					1.3			

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Table 5 cont.
Riverdale 1986 Gas Chromatographic Data

All Units: ug/m3 (micrograms per cubic metr

	MAMU 2 N/A Upwind JUN 10 11:52	MAMU 2 B102 Sewage Trt. Plt. JUN 10 13:17	MAMU 2 B102 JUN 10 14:32	MAMU 1 A102 AR Clarke JUN 10 14:33	MAMU 1 A102 JUN 10 15:33	MAMU 1 A132 Canadian Oil JUN 13 12:28	MAMU 1 A133 JUN 13 13:41	MAMU 1 A134 JUN 13 14:42	MAMU 1 A171 Rothsay Concentrates JUN 17 11:25	MAMU 1 A172 JUN 17 12:40	MAMU 1 A172 JUN 17 13:23	MAMU 1 A173 Canadian Oil JUN 17 14:44	MAMU 1 A173 JUN 17 15:26	MAMU 1 A174 Upwind JUN 17 16:09	MAMU 1 A192 Darl. Re JUN 19 13:00
42 BENZENE	6.8	4.8	2.3	4.7	5.1	4.3	9.6	4.8	30.1	9.0	14.9	14.4	45.5	8.5	19.0
43 TETRACHLOROMETHANE															
44 CYCLOHEXANE	1.0	0.7		0.1	0.2	1.0	6.9	5.9	1.0	0.7	0.5	9.4	6.9	0.5	1.0
45 2-METHYLHEXANE	2.3	1.4		1.2	1.5	1.2		3.1	6.7	2.5	0.9	6.9	5.3	1.3	
46 2,3-DIMETHYLPENTANE				1.3	1.7	1.4		3.5	7.6	2.9	1.0	7.9	6.0	1.5	6.9
47 CYCLOHEXENE												0.6			
48 3-METHYLHEXANE	2.4	1.5	0.5	0.8	1.1	1.0	3.8	2.2	5.3	1.7	0.9	5.0	4.4	0.9	4.3
49 1,2-DICHLOROPROPANE												0.6			
50 2,3-DICHLOROPROPENE												2.9			
51 TRICHLOROETHENE							6.9								
52 2,2,4-TRIMETHYLPENTANE	2.0	1.1		0.7	1.0	0.7	3.4	2.7	4.1	1.7	1.0	4.3	3.3	0.6	2.8
53 1-HEPTENE							1.0	0.8		0.5		1.2	0.7		
54 HEPTANE	1.9	1.2	0.5	0.7	0.9	0.7	4.1	3.6	5.0	1.4	0.7	5.7	4.1	0.5	2.9
55 1-CHLORO-3-METHYLBUTANE												0.9	0.7		
56 TRANS-2-HEPTENE												0.8			
57 METHYLCYCLOHEXANE	1.3	1.0													
58 4-METHYLCYCLOHEXENE							0.7								
59 2,5-DIMETHYLHEXANE							0.5	0.5	0.9	0.4		0.9	0.7		0.6
60 1-CHLOROPENTANE							1.0	1.0				1.4	1.0		
61 1,1,2-TRICHLOROETHANE															
62 TOLUENE	8.0	10.2	5.8	7.6		8.3	20.5	22.6	82.7	16.3	7.5	22.1	22.7	9.9	26.3

Table 5 cont.
Riverdale 1986 Gas Chromatographic Data
All Units: ug/m3 (micrograms per cubic metre)

		MAMU 2 N/A Upwind JUN 10 11:52	MAMU 2 B102 Sewage JUN 10 13:17	MAMU 1 B102 Trt. Plt. JUN 10 14:32	MAMU 1 A102 AR Clarke JUN 10 14:33	MAMU 1 A102 JUN 10 15:33	MAMU 1 A132 JUN 13 12:28	MAMU 1 A133 JUN 13 13:41	MAMU 1 A134 JUN 13 14:42	MAMU 1 A171 Rothsay JUN 17 11:25	MAMU 1 A172 Concentrates JUN 17 12:40	MAMU 1 A172 JUN 17 13:23	MAMU 1 A173 Canadian Oil JUN 17 14:44	MAMU 1 A173 Oil JUN 17 15:26	MAMU 1 A174 Upwind JUN 17 16:09	MAMU 1 A192 Darl. Rem JUN 19 13:00
63	1,3-DICHLOROPROPANE															
64	2-METHYLHEPTANE			0.6			0.2	1.9	1.9	3.3	1.1	0.5	2.7	2.6	0.2	1.3
65	4-METHYLHEPTANE							0.8	0.7	1.4	0.5		1.1	1.1		0.6
66	3-METHYLHEPTANE				0.6		0.8	3.4	3.3	3.9	1.6	1.2	4.3	3.9	1.1	2.9
67	1,2-DIBROMOETHANE					2.7										
68	1-OCTENE							0.6	0.7		0.3		0.9	0.7		
69	TRANS12DIMETHYLCYCLOHEXAN	3.9	2.9	2.1				0.4	0.4		0.2		0.6	0.5		
70	TRANS-4-OCTENE															
71	TETRACHLOROETHENE							2.9	5.1		1.7		4.8	4.2		2.1
72	OCTANE	3.4	2.6	1.9	0.9		0.4	2.8	3.6	4.5	1.5	0.9	4.2	3.7	0.4	2.2
73	2-METHYL-1-HEPTENE				0.6	0.6			0.5	1.6	0.3		0.8	0.6		
74	2-OCTENE															
75	CIS12DIMETHYLCYCLOHEXANE							0.6	0.7				0.6			
76	CHLOROBENZENE								0.3		0.2		0.3			0.3
77	ETHYLCYCLOHEXANE							1.0		2.2	0.9		1.5			1.0
78	PROPYLCYCLOPENTANE							2.2		4.9	2.0		3.2			2.2
79	1-CHLOROHEXANE															
80	ETHYLBENZENE	1.8	2.9	2.0	24.3		1.9	4.0	6.7	12.5	3.8	2.5	4.4			5.4
81	M-XYLENE	4.8	8.9	6.4	74.9	0.7	7.4	12.1	23.5	41.1	11.1	8.4	13.1			16.5
82	4-METHYLOCTANE				0.7			1.1	1.7	0.9	0.6		1.5			0.7
83	2-METHYLOCTANE												0.8			

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Table 9

Data Summary: Odours `Fingerprint' (TAGA)
Targeet Source: Canadian Oil (Riverdale /86 Survey)

Compounds Detected[A]	Estimated Averaged Concentration (ug/m^3)[B]			
File	RD33	RD44	RD45	RD54
acetone	ND	ND	1	2
butanone	ND	ND	1	ND
ethanol	ND	ND	10	ND
phenol	5	ND	ND	ND
C_2 alkyl benzenes[C]	ND	ND	5	10
C_3 alkyl benzenes[D]	ND	ND	20	10
C_4 alkyl benzenes[E]	ND	ND	5	ND

Notes:
A. based on the interpretation of APCI/MS data
B. 2-minute averaged concentrations-estimated (+-3X)
C. sum of C_8H_{10} isomers eg. xylenes, ethyl benzene
D. sum of C_9H_{12} isomers eg. propyl benzene, trimethylbenzene
E. sum of $C_{10}H_{14}$ isomers eg. butyl benzene

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Table 5 cont.
Riverdale 1986 Gas Chromatographic Data

All Units: ug/m3 (micrograms per cubic metre

	MAMU 2 N/A Upwind JUN 10 11:52	MAMU 2 B102 Sewage JUN 10 13:17	MAMU 2 B102 Trt. Plt. JUN 10 14:32	MAMU 1 A102 AR Clarke JUN 10 14:33	MAMU 1 A102 JUN 10 15:33	MAMU 1 A132 Canadian Oil JUN 13 12:28	MAMU 1 A133 JUN 13 13:41	MAMU 1 A134 JUN 13 14:42	MAMU 1 A171 Rothsay Concentrates JUN 17 11:25	MAMU 1 A172 JUN 17 12:40	MAMU 1 A172 JUN 17 13:23	MAMU 1 A173 Canadian Oil JUN 17 14:44	MAMU 1 A173 JUN 17 15:26	MAMU 1 A174 Upwind JUN 17 16:09	MAMU 1 A192 Darl. Re JUN 19 13:00
84 STYRENE				0.4				0.3	1.5	0.4					1.2
85 1,4-DICHLOROBUTANE					0.4										
86 O-XYLENE	1.8	2.6	1.8	9.1		2.3	4.4	9.3	10.3	3.1	3.3	4.8			5.0
87 1,1,2,2-TETRACHLOROETHANE				2.8											
88 1,2,3-TRICHLOROPROPANE					0.7							0.3			
89 1-NONENE				2.1	0.2							2.7	8.0	2.7	2.1
90 NONANE		1.1	0.7				2.1	3.7	3.1	0.8	0.9				
91 ISOPROPYLBENZENE				1.3			0.4	0.6		0.3		0.5			
92 2-CHLOROTOLUENE				0.7											
93 3-CHLOROTOLUENE					0.9										
94 PROPYLBENZENE		1.4	1.0			0.4	1.3	3.2	2.9	0.8		2.0	0.4		
95 4-CHLOROTOLUENE				4.6		0.4	1.5		2.9				0.7		0.4
96 3-ETHYLTOLUENE	1.6	4.0	2.8	7.0			3.4	9.6	6.6	1.9		4.0			
97 4-ETHYLTOLUENE	2.0	2.3	1.7		4.6			3.2			0.8	1.5			1.3
98 1,3,5-TRIMETHYLBENZENE	2.6	3.1	2.3				2.6	7.4	5.2	1.5		3.6			
99 2-ETHYLTOLUENE	1.8	2.1	1.6		5.4		1.5	3.4	2.5	0.7		1.5			
100 1,2,4-TRIMETHYLBENZENE	2.6	4.9	3.1		24.5	1.8	5.8	18.9		2.6	4.2	7.4			5.3
101 tert-BUTYLBENZENE							7.5	15.7		3.4	5.4	9.6			6.7
102 1,3-DICHLOROBENZENE															
103 1-DECENE															
104 (CHLOROMETHYL)BENZENE															

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Table 5 cont.
Riverdale 1986 Gas Chromatographic Data

All Units: ug/m3 (micrograms per cubic metre)

	MAMU 2 N/A Upwind JUN 10 11:52	MAMU 2 B102 Sewage JUN 10 13:17	MAMU 2 B102 Trt. Plt. JUN 10 14:32	MAMU 1 A102 AR JUN 10 14:33	MAMU 1 A102 Clarke JUN 10 15:33	MAMU 1 A132 JUN 13 12:28	MAMU 1 A133 Canadian Oil JUN 13 13:41	MAMU 1 A134 JUN 13 14:42	MAMU 1 A171 JUN 17 11:25	MAMU 1 A172 Rothsay Concentrates JUN 17 12:40	MAMU 1 A172 JUN 17 13:23	MAMU 1 A173 Canadian JUN 17 14:44	MAMU 1 A173 Oil JUN 17 15:26	MAMU 1 A174 Upwind JUN 17 16:09	MAMU 1 A192 Darl. Re JUN 19 13:00
105 1,5-DICHLOROPENTANE				1.6											
106 DECANE		3.8	2.7				4.2	13.1		1.8	2.2	5.8	4.4	1.2	2.6
107 SEC-BUTYLBENZENE															
108 3-(CHLOROMETHYL)HEPTANE					2.0								0.7		
109 1,2,3-TRIMETHYLBENZENE		2.7	2.1				3.0	10.0	3.5	1.5		4.2	1.4	0.5	
110 1ISOPROPYL4METHYLBENZENE															1.7
111 1,2-DICHLOROBENZENE					1.1										
112 INDAN							0.7	3.1	1.4	0.4	0.6	1.6			0.5
113 BUTYLCYCLOHEXANE												1.0			
114 1,3-DIETHYLBENZENE								1.5				0.6	0.9		
115 1,4-DIETHYLBENZENE					3.6		1.1	3.7		0.5		1.4	0.9		
116 BUTYLBENZENE		1.3								0.4					
117 1,2-DIETHYLBENZENE					0.9										
118 T-DECALIN															
119 C-DECALIN															
120 UNDECANE		5.2	4.7	13.0	8.9	4.7	7.4	27.6	2.3	4.5	3.7	7.1	1.6		3.5
121 1235-TETRAMETHYLBENZENE				1.1	1.7		2.0	8.3		0.6	1.1	2.3			1.0
122 1234-TETRAMETHYLBENZENE				2.0			1.3	7.2		1.1	1.4	1.4			0.9
123 1234-TETRAHYDRONAPTHALENE								1.6							
124 1,4-DIISOPROPYLBENZENE															
125 DODECANE		3.3	2.5	3.7	3.5	1.7	3.1	8.5	2.4	3.2	2.6	2.4	3.1	1.2	2.2

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'11/05/87

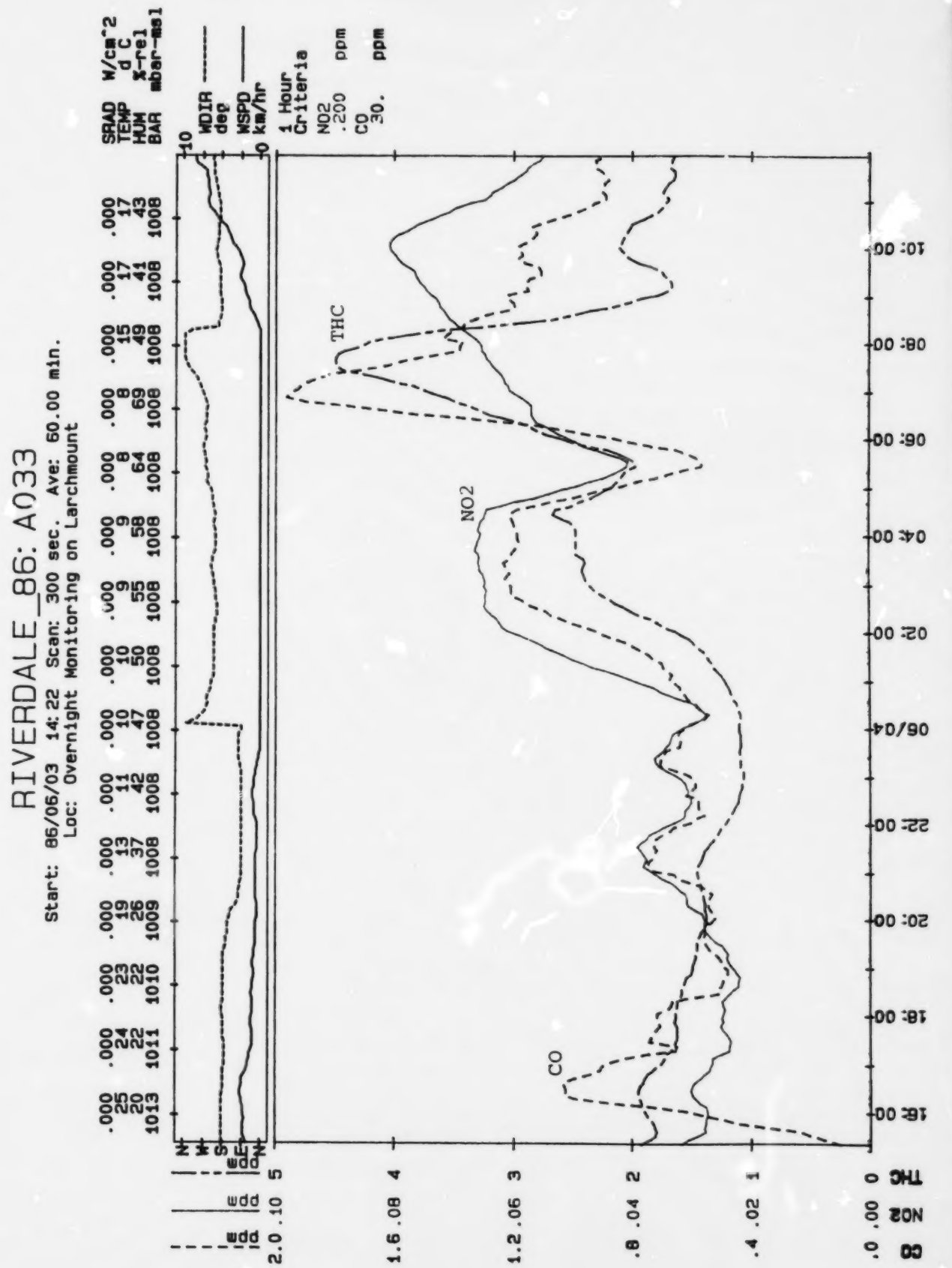
Table 5 cont.
Riverdale 1986 Gas Chromatographic Data

All Units: ug/m3 (micrograms per cubic metre

	MAMU 2 N/A Upwind JUN 10 11:52	MAMU 2 B102 Sewage JUN 10 13:17	MAMU 2 B102 Trt. Plt. JUN 10 14:32	MAMU 1 A102 AR JUN 10 14:33	MAMU 1 A102 Clarke JUN 10 15:33	MAMU 1 A132 Canadian Oil JUN 13 12:28	MAMU 1 A133 Canadian Oil JUN 13 13:41	MAMU 1 A134 Canadian Oil JUN 13 14:42	MAMU 1 A171 Rothsay JUN 17 11:25	MAMU 1 A172 Concentrates JUN 17 12:40	MAMU 1 A172 JUN 17 13:23	MAMU 1 A173 Canadian JUN 17 14:44	MAMU 1 A173 Oil JUN 17 15:26	MAMU 1 A174 Upwind JUN 17 16:09	MAMU 1 A192 Darl. Re JUN 19 13:00
Total Compounds Identified	36	41	31	45	41	33	60	65	46	64	37	80	50	25	50
Total Hydrocarbons ug/m3	198.4	200.8	96.4	242.8	168.6	193.2	309.5	464.5	568.2	214.7	125.1	510.6	273.1	61.3	445.4
Alkanes ug/m3	119.1	81.5	27.1	80.9	99.8	145.5	160.4	247.9	312.8	129.6	62.5	298.4	138.4	33.4	306.4
Cycloalkanes ug/m3	12.7	8.5	3.6	1.3	2.0	9.0	15.1	15.3	16.5	7.2	2.6	23.7	13.3	2.7	5.6
Alkenes ug/m3	10.5	5.1	1.4	5.7	4.6	0.5	21.5	18.2	8.3	9.7	5.4	44.4	24.4	0.0	14.2
Cycloalkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Alkynes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aromatics ug/m3	33.8	51.2	33.0	132.3	46.6	26.4	81.1	164.3	200.2	59.3	50.1	100.3	71.7	18.9	90.9
Chlorinated Alkanes ug/m3	22.3	54.5	31.3	17.5	13.7	11.4	19.3	13.4	27.6	6.7	4.5	32.8	19.2	6.3	23.4
Chlorinated Alkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	9.8	5.1	0.0	2.1	0.0	10.1	5.3	0.0	2.1
Chlorinated Aromatics ug/m3	0.0	0.0	0.0	5.3	2.0	0.4	1.5	0.3	2.9	0.2	0.0	0.3	0.7	0.0	0.7

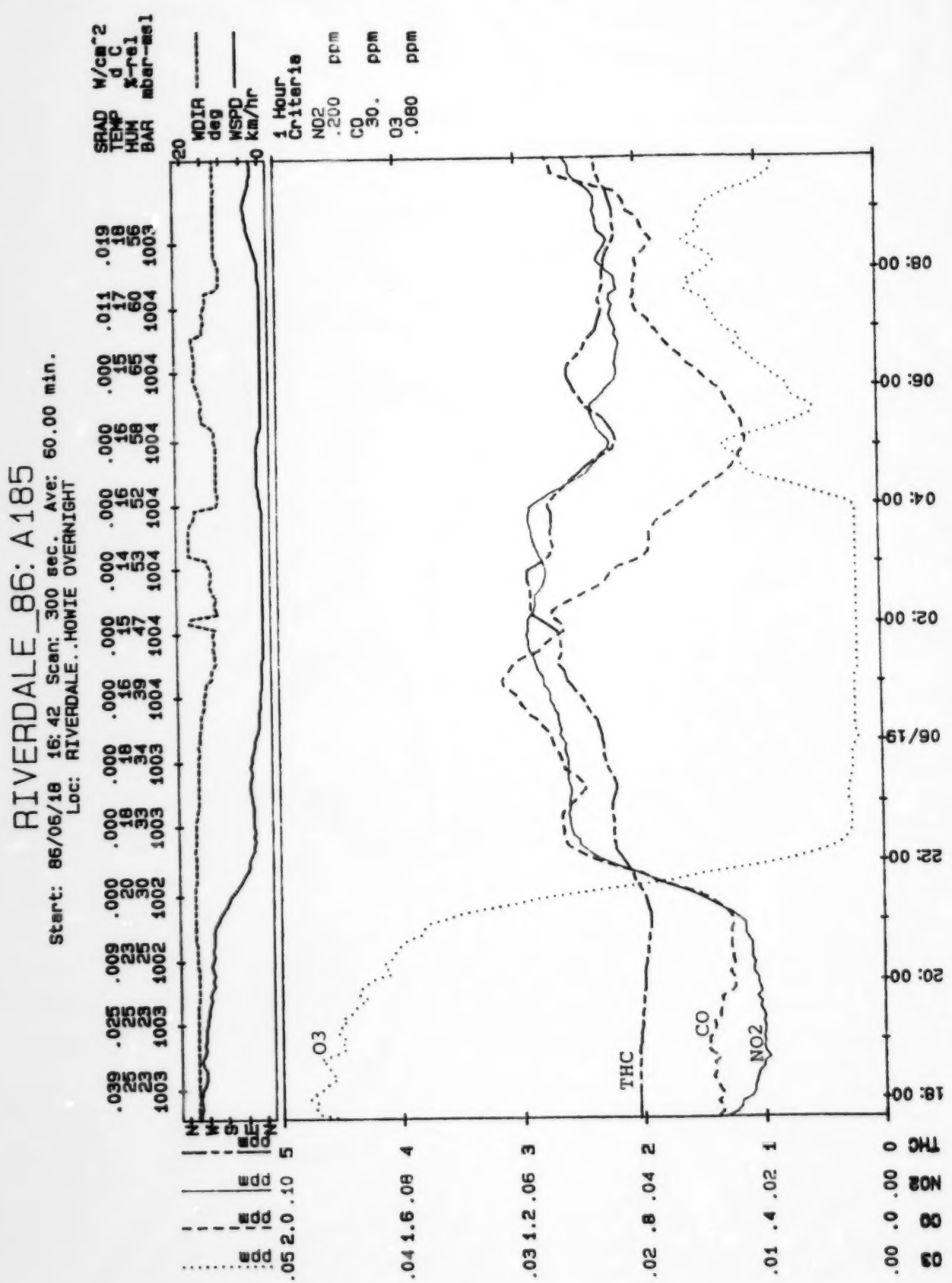
GRAPH 1

Concentration/Time Graph for MP A033



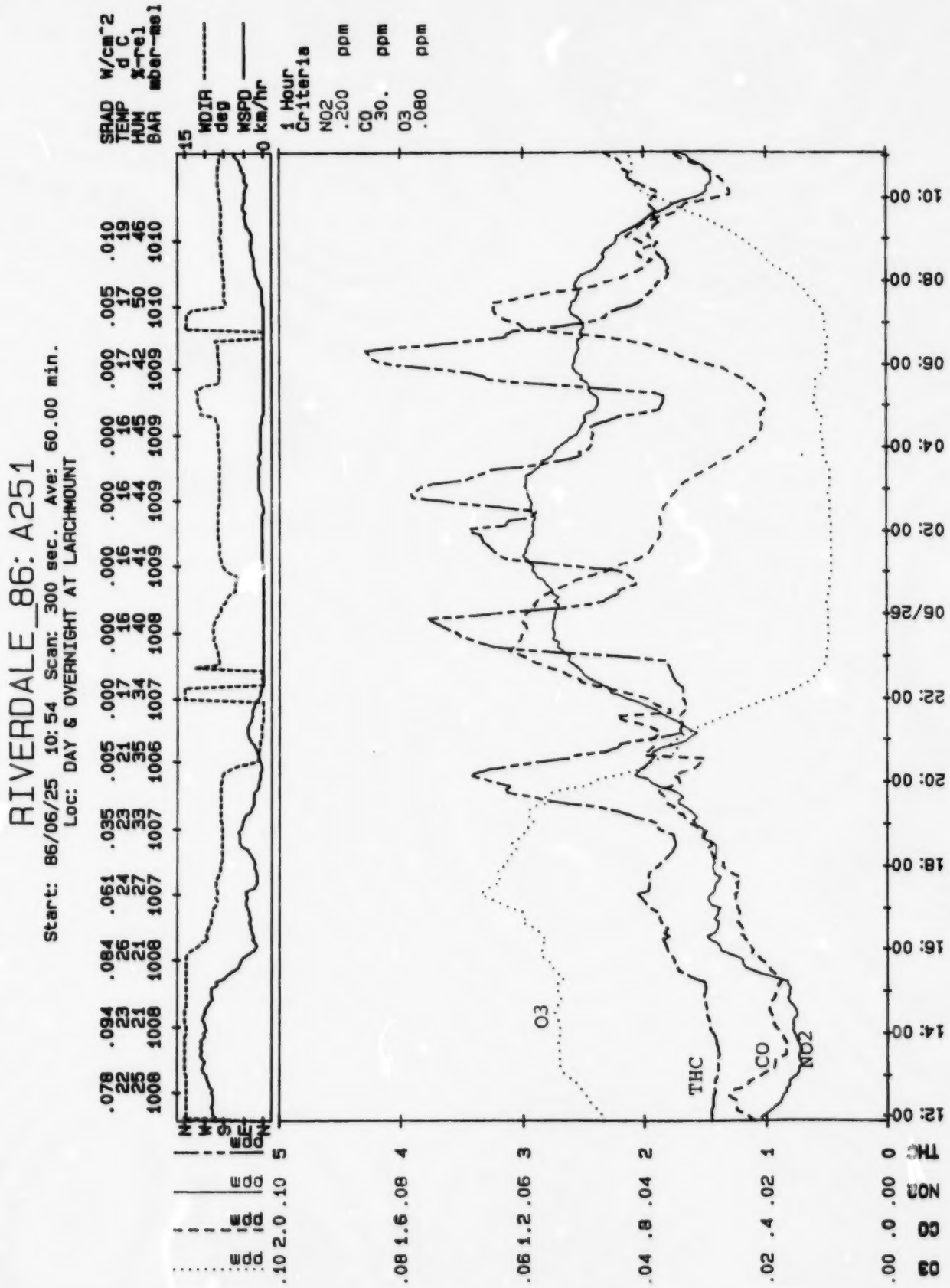
GRAPH 2

Concentration/Time Graph for MP A185



GRAPH 3

Concentration/Time Graph for MP A251



APPENDIX B

Environmental Data as Acquired By MAMU #3 (TAGA 3000)

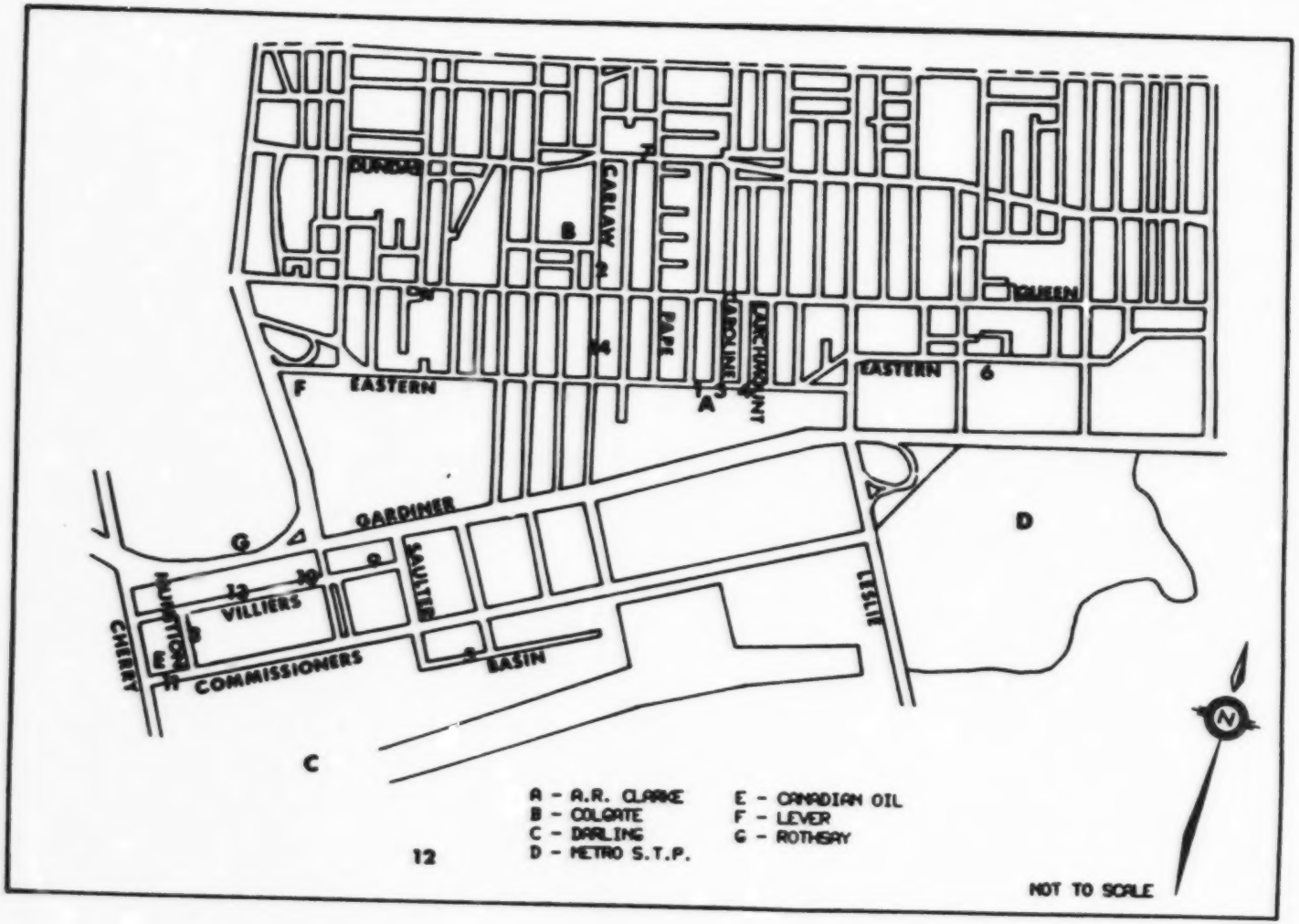
Table 6: Monitoring Periods and Sampling Locations

FILE	DATE	TIME	COMPANY	LOCATION	SITE #	MET			COMMENTS
						AT	WS	WD	
RD03	JUNE 03	13:44	A. R. CLARK	644 EASTERN AV.	1	24	0-5	ENE	ODOURS
RD11	JUNE 18	11:34	COLGATE	201 CARLAW	2	23	0-10	NNW	SOAPY ODOUR DETECTED
RD12	JUNE 18	11:40	COLGATE	201 CARLAW	2	24	0-10	S	NO ODOURS
RD13	JUNE 18	12:21	A. R. CLARK	EASTERN & CAROLINE	3	24	0-10	W	SLIGHT ODOURS/PLUME SHIFTED
RD14	JUNE 18	12:45	A. R. CLARK	EASTERN & LARCHMOUNT	4	24	5-15	WSW	MODERATE RENDERING ODOUR
RD15	JUNE 18	13:09	A. R. CLARK	EASTERN & LARCHMOUNT	4	25	0-10	W	ODOUR NOT AS STRONG
RD16	JUNE 18	13:19	A. R. CLARK	EASTERN & LARCHMOUNT	4	25	3-12	W	ODOURS WEAK
RD19	JUNE 19	11:27	DARLING	25m W OF BOUCHETTE ON BASIN	5	18	5-10	SW	MODERATE RENDERING ODOUR
RD20	JUNE 19	11:38	DARLING	25m W OF BOUCHETTE ON BASIN	5	18	0-5	SW	ODOUR NOT AS STRONG
RD21	JUNE 19	12:19	DARLING	25m W OF BOUCHETTE ON BASIN	5	18	0-5	SW	OCCASIONAL ODOUR INCIDENT
RD22	JUNE 19	12:36	DARLING	25m W OF BOUCHETTE ON BASIN	5	18	0-3	SW	BEGAN TO RAIN
RD25	JUNE 20	13:57	METRO S.T.P.	TORONTO POST OFFICE P.L.	6	27	10-15	S	ODOUR DECREASED WITH TIME
RD26	JUNE 20	14:14	METRO S.T.P.	TORONTO POST OFFICE P.L.	6	27	10-18	SSW	NO ODOUR
RD27	JUNE 23	10:50	COLGATE	20m W OF PAPE ON DUNDAS	7	25	3-13	SW	FAINT SOAPY ODOUR
RD28	JUNE 23	11:08	COLGATE	20m W OF PAPE ON DUNDAS	7	27	0-10	SW	FAINT SOAPY ODOUR
RD32	JUNE 23	12:41	COLGATE	50m N OF QUEEN ON CARLAW	2	30	3-13	NW	INTERMITTENT SOAPY ODOUR
RD33	JUNE 23	13:33	CANADIAN OIL	MUNITION ST.	8	30	10-20	W	OILY ODOUR
RD34	JUNE 23	13:56	CANADIAN OIL	MUNITION ST.	8	30	15-25	W	OILY ODOUR

(continued...)

Table 6: Monitoring Periods and Sampling Locations (continued)

FILE	DATE	TIME	COMPANY	LOCATION	SITE #		MET		COMMENTS
RD37	JUNE 24	10:15	LEVER	100m W OF SAULTER ON VILLIERS	9	18	10-30	WNW	FAINT RENDERING & DETERGENT ODOURS
RD38	JUNE 24	10:41	LEVER	100m W OF SAULTER ON VILLIERS	9	19	10-20	WNW	FAINT RENDERING & DETERGENT ODOURS
RD39	JUNE 24	10:54	ROTHSAY CONC.	DON RDWY & VILLIERS	10	20	10-15	WNW	
RD40	JUNE 24	11:03	ROTHSAY CONC.	DON RDWY & VILLIERS	10	21	5-15	WNW	STRONG RENDERING ODOUR
RD43	JUNE 24	12:17	CANADIAN OIL	CHERRY & COMMISSIONERS	11	18	10-20	WNW	INTERMITTENT, MODERATE ODOUR
RD44	JUNE 24	12:24	CANADIAN OIL	CHERRY & COMMISSIONERS	11	19	10-20	WNW	INTERMITTENT, MODERATE ODOUR
RD45	JUNE 24	12:49	CANADIAN OIL	CHERRY & COMMISSIONERS	11	23	7-20	NW	STRONG OILY ODOUR
RD46	JUNE 24	13:24	CANADIAN OIL	CHERRY & COMMISSIONERS	11	18	10-30	NNW	STRONG OILY ODOUR
RD47	JUNE 24	14:06	DARLING	WINDSURFING CLUB RD. OFF UNWIN	12	15	20-30	NW	INTERMITTENT ODOUR
RD48	JUNE 24	14:14	DARLING	WINDSURFING CLUB RD. OFF UNWIN	12	15	25-45	NNW	STRONG ODOUR
RD49	JUNE 24	14:36	DARLING	WINDSURFING CLUB RD. OFF UNWIN	12	15	25-45	NNW	MODERATE ODOUR
RD50	JUNE 25	10:00	ROTHSAY CONC.	VILLIERS	13	21	5-10	NNW	STRONG RENDERING ODOUR
RD51	JUNE 25	10:36	ROTHSAY CONC.	VILLIERS	13	21	5-10	NW	STRONG RENDERING ODOUR
RD54	JUNE 25	11:25	CANADIAN OIL	CHERRY & COMMISSIONERS	11	22	10-25	NNW	STRONG OILY ODOUR
RD55	JUNE 25	12:01	CANADIAN OIL	CHERRY & COMMISSIONERS	11	23	10-20	NNW	STRONG OILY ODOUR
RD56	JUNE 25	12:41	COLGATE	CARLAW & EASTERN	14	21	10-15	NNW	FAINT SOAPY ODOUR
RD57	JUNE 25	12:53	COLGATE	CARLAW & EASTERN	14	21	5-15	NNW	FAINT SOAPY ODOUR
RD58	JUNE 25	13:30	COLGATE	CARLAW & EASTERN	14	21	10-20	NNW	MODERATE SOAPY ODOUR
RD61	JUNE 25	14:28	COLGATE	CARLAW & QUEEN	2	25	0-10	N	MODERATE SOAPY ODOUR
RD62	JUNE 25	14:51	COLGATE	CARLAW & QUEEN	2	26	0-10	N	MODERATE SOAPY ODOUR



Map 3: MAMU #3 (TAGA) Monitoring Locations
Riverdale Survey (June, 1986)

Table 7

Data Summary: Odours 'Fingerprint' (TAGA)
Target Source: A.R. Clark (Riverdale /86 Survey)

Compounds Detected[A]	Estimated Averaged Concentration (ug/m^3)[B]			
	File RD03	RD13	RD14	RD16
acetone	30	ND	10	ND
ammonia	10	4	3	5
butyl methacrylate[C]	60	ND	5	ND
cyclohexylamine[C]	40	2	2	2
diethylamine	100	20	40	3
C_2 alkyl benzenes[D]	170	ND	30	20
C_3 alkyl benzenes[E]	300	ND	40	20

Notes:
A. based on the interpretation of APCI/MS data
B. 2-minute averaged concentrations - estimated (+-3X)
C. tentative, identifications not confirmed
D. sum of C_8H_{10} isomers eg. xylenes, ethyl benzene
E. sum of C_9H_{12} isomers eg. propyl benzene, trimethylbenzene

Table 8

Data Summary: Odours 'Fingerprint' (TAGA)
Target Source: Darling Rendering (Riverdale /86 Survey)

Compounds Detected[A]	Estimated Averaged Concentration (ug/m^3)[B]		
File	RD19/20	RD21/22	RD47/48
acetic acid	5	5	ND
butanone	1	1	ND
butylamine	<1	<1	<<1
propanal	1	<1	<1
propyl amine	<1	<1	ND
C_2 alkyl benzenes[C]	5	5	ND
C_3 alkyl benzenes[D]	10	5	ND

Notes:
A. based on the interpretation of APCI/MS data
B. 2-minute averaged concentration - estimated (+-3X)
C. sum of C_8H_{10} isomers eg. xylenes, ethyl benzene
D. sum of C_9H_{12} isomers eg. propyl benzene, trimethylbenzene

Table 10

Data Summary: Odours 'Fingerprint' (TAGA)
Target Source: Rothsay Concentrates (Riverdale /86 Survey)

Compounds Detected[A]	Estimated Averaged Concentration (ug/m^3)[B]	
	File RD39/40	RD50/51
butylamine	2	1

Notes: A. based on the interpretation of APCI/MS data
B. 2-minute averaged concentration-estimated (+-3X)

Table 11

Data Summary: Odours 'Fingerprint' (TAGA)
Target Source: Colgate - Palmolive (Riverdale /86 Survey)

Compounds Detected[A]	Estimated Averaged Concentration (ug/m^3)[B]				
	File	RD12	RD27	RD32	RD57	RD61
acetone		ND	2	ND	ND	2
acetic acid		ND	ND	ND	ND	1
butanone		ND	10	ND	2	5
cyclohexanone[C]		ND	ND	ND	ND	2
ethanol		ND	ND	5	ND	10
C_2 alkyl benzene[D]		ND	ND	ND	ND	10

Notes:
A. based on the interpretation of APCI/MS data
B. 2-minute averaged concentration-estimated (+-3X)
C. tentative, identifications not confirmed
D. sum of C_8H_{10} isomers

Table 12

Data Summary: Odours 'Fingerprint' (TAGA)
Target Source: Lever Brothers (Riverdale /86 Survey)

Compounds Detected[A]	Estimated Averaged Concentration (ug/m^3)[B]
	File RD37/38
butylamine[C]	3

Notes:
A. based on the interpretation of APCI/MS data
B. 2-minute averaged concentration-estimated (+-3X)
C. probably originated from Rothsay Concentrates